



May 1, 2006

Mr. John Merritt, Esq.
Merritt & Associates, P.C.
917 North Robinson
Oklahoma City, OK 73102

Re: *Raley v. Hyundai*

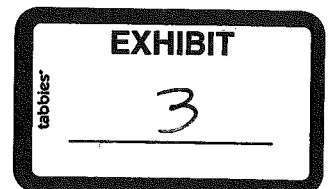
Dear Mr. Merritt:

This letter provides a summary of our preliminary systems analysis of the 1999 Hyundai Sonata rollover crash that catastrophically injured Misty Raley.

Mr. Friedman's CV is Attachment A. His qualifications, in brief, are as follows: After a 36-year vehicle research and development career, he began conducting detailed systems analyses of catastrophic injury accidents. In the last 21 years, he has conducted over 700 detailed systems analyses of catastrophic injury accidents in accordance with his 1989 protocol published by the Society of Automotive Engineers. He has also testified by deposition in approximately 400 rollover cases and in trial more than 50 times. He has published more than 70 peer-reviewed papers, including more than 20 in the past 15 years that are related to head and neck injury in rollover accidents. The human rollover experimentation of Mr. Friedman and his colleagues is unparalleled since the human frontal impact research of the 1960s. Mr. Friedman's list of cases is given in Attachment B.

For the purpose of characterizing our opinions and the basis for them in the above-referenced matter, we have used an established scientific systems analysis method. Systems analysis is a rational approach to understanding crashes and the injuries that result from them that considers all aspects of the automotive system through the full crash sequence. This analysis enables us to assess and determine whether some aspect of a vehicle's design, construction and performance is defective and caused the crash injuries.

Our traditional systems analysis uses well established methodology and protocols. It includes opinions and proofs based on crash statistics, vehicle dynamics, occupant kinematics, injury susceptibility and mechanism, crashworthiness, and occupant protection. It uses testing; assessments of safety defects and how they cause crashes and injuries; determination of the foreseeability of consequences; and negligence and conscious disregard of those consequences. This analysis focuses only on relevant information and the performance of systems operating in accordance with experimental evidence and the laws of physics.



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Our opinions integrate all currently available, relevant information. They are provided pending receipt of requested discovery, a review of defense expert testimony and a subsequent decision of plaintiff's counsel as to how to use such documents. We will defer to other retained colleagues in their disclosed expert areas in this case. Any overlapping, detailed case-specific opinions herein stated are preliminary pending final coordination with other experts.

Summary of the Accident¹:

On December 19, 2003 at approximately 9:40 pm, Misty Raley, a 5'5" tall, 180 pound, 30 year old female, was driving northbound on U.S. Highway 62 in Oklahoma City in a 1999 Hyundai Sonata (VIN KMHWF25S8XA126203). She was reportedly unrestrained and ejected. Her side impact air bag was deployed. There were 3 other restrained occupants in the vehicle.

The vehicle veered to the right striking a group of sand barrels before entering a counterclockwise yaw and moving off the roadway to the left. The vehicle slid and rolled down an embankment before coming to rest. The driver was ejected 6' north of the POR of the vehicle. The police report accident diagram is reproduced in Figure 1.

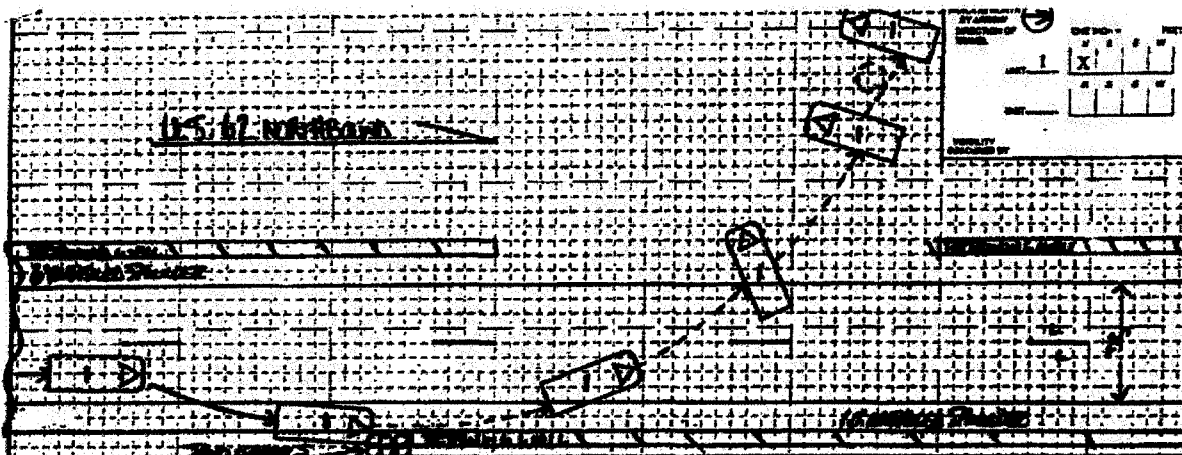


Figure 1: Police Report Accident Diagram

The Vehicle^{2,3}:

The vehicle, a 1999 Hyundai Sonata, has suffered significant damage consistent with a rollover. There is damage to the entire vehicle both from the initial side swipe contact with the sand barrels and the subsequent rollover. The damage to the roof of the vehicle is concentrated above the driver's seating position, see Figure 2.

¹ Official Oklahoma Traffic Collision Report, #45864.

² Provided photographs of the accident vehicle.

³ Xprts-LLC Inspection on 2/16/05.

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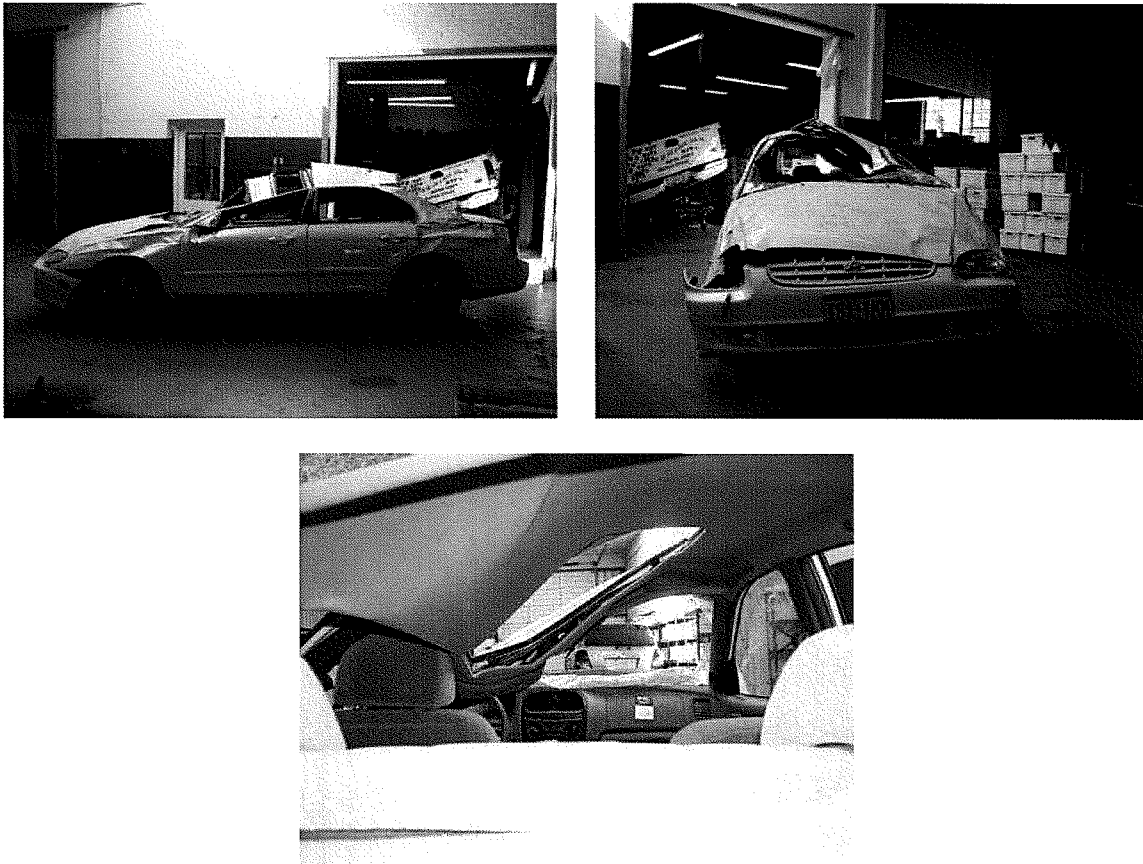


Figure 2: Overview pictures of the vehicle showing rollover damage.

The driver's side front window was up prior to the accident as demonstrated by the glass fragments retained in the window gasket, see Figure 3.



Figure 3: Glass fragments in the window gasket.

The police report and medical reports indicate that Ms. Raley was unrestrained, but an inspection of the vehicle reveals evidence to suggest that she was wearing her belt. Investigators often assume an ejected occupant was unbelted. Scuff marks can be seen at approximately 38 inches and 44 inches on the driver's belt, as measured from the anchor point, see Figure 4. Numerous torn threads are also visible along the length of the belt. The presence of the scuff marks and torn threads on the belt are consistent with the belt being in use at the time of the accident and released as a result of false latching or inertial unlatching leading to her ejection.



Figure 4: Scuff marks and torn threads on the driver's belt, indicating it was in use at the time of the accident.

The length of the scuff marks and torn threads is likely attributable to the belt being dragged through the latch plate. When a surrogate of roughly the same size as Ms. Raley was placed into an exemplar vehicle, the surrogate's belt passed through the latch plate at approximately this location, see Figure 5.



Figure 5: Surrogate seated in an exemplar vehicle, belt passes through latch plate near 38".

At the driver's seating location, there is approximately 28.25 inches of residual headroom, see Figure 6. An exemplar inspection indicates the original headroom was 38 inches.

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At this position, the residual roof crush was 9.75 inches with an additional 20-30% dynamic crush during the rollover.

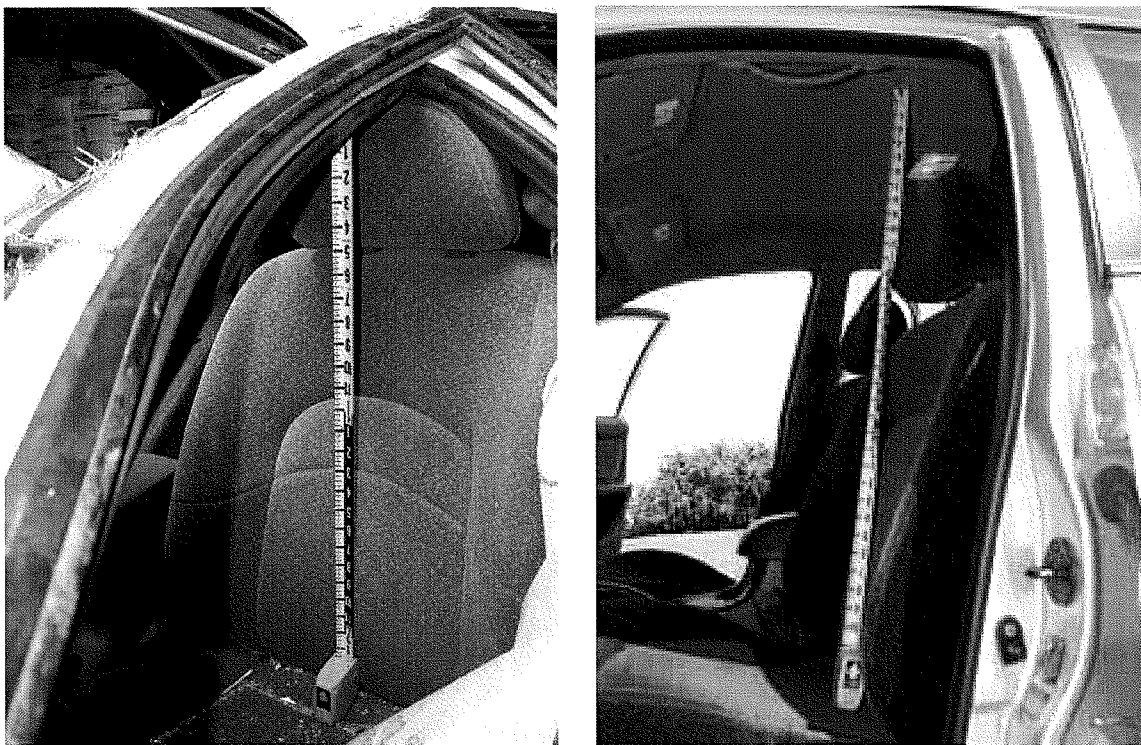


Figure 6: Driver's Headroom Comparison Between the Accident and an Exemplar Vehicle.

Blood is present on the inside surface of the deployed side impact airbag, which illustrates that Ms. Raley sustained injury inside the vehicle before being ejected, see Figure 7. Additionally, there is blood on the exterior surface of the driver side roof rail, see Figure 8. Ms. Raley most likely sustained injury inside the vehicle, at which point blood was transferred to the air bag, and she was subsequently ejected from the vehicle, at which time blood transferred to the roof rail.

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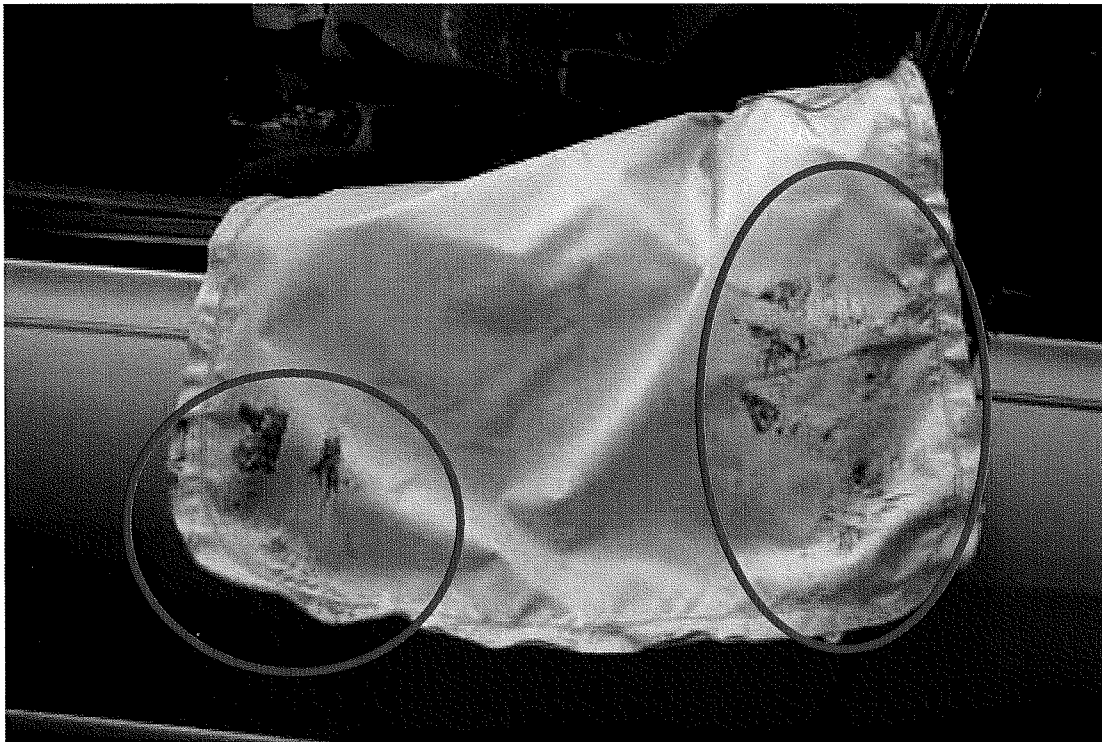


Figure 7: Blood is present on the interior surface of the side impact airbag, indicating Ms. Raley sustained injury inside the vehicle before being ejected.



Figure 8: Blood on driver side roof rail, where it was transferred as Ms. Raley was ejected from the vehicle.

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There is some light sideswipe damage along the passenger side of the vehicle from the contact with the sand barrels on the side of the road. This damage is depicted in Figure 9.

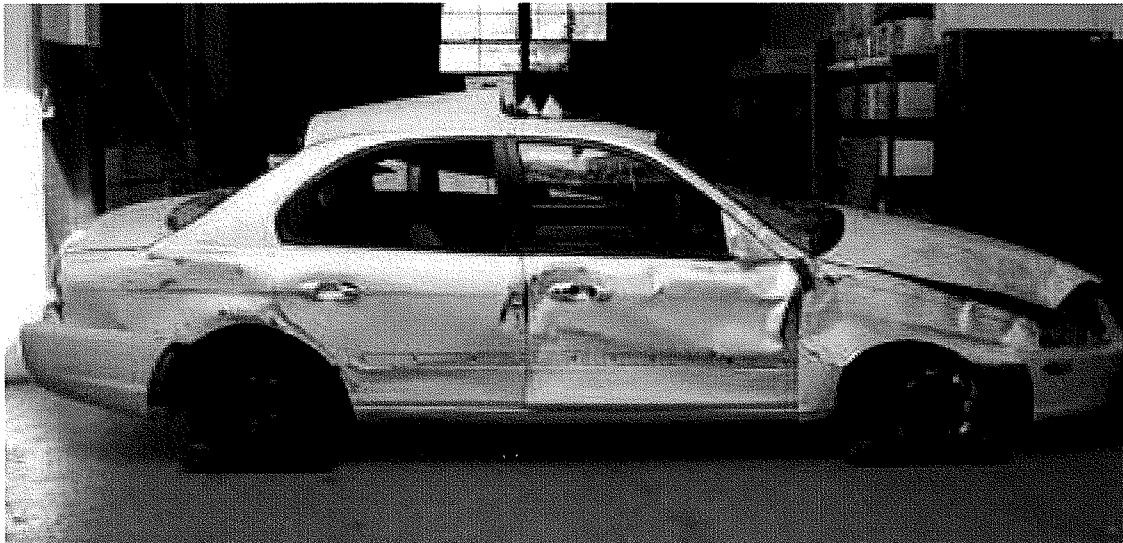


Figure 9: Sideswipe damage on passenger side of vehicle.

Injuries:

Misty Raley:

Misty Raley is quadriplegic as a result of the accident. The injuries include:

- Cervical spine fractures at C5 and C6. Fractures with dislocation at C6-7 with bone fragments injuring the spinal cord.
- Thoracic spine fractures at T1 through T6. Forward dislocation of C7 on T1.
- Bilateral lung contusions.
- Bilateral apical pneumothoraces.
- Right 1st through 3rd rib fractures.
- Right clavicle fracture.
- Right scapula fracture.
- Two cm laceration to the right upper forehead. Four cm laceration to the right temple area. Laceration/abrasion to the left eyebrow. Contusion to the right lateral chest area at the nipple line. Abrasion/contusion of the right knee.
- Paraspinal hematoma.
- Scalp hematoma near the vertex.
- Quadriplegia

Injury Causation:

Misty Raley suffered a C5-C6 fracture with dislocation at C6-C7 resulting in catastrophic injury to her spinal cord. This injury is caused by rapid and extensive neck flexion of at least 7

miles per hour and more probably in excess of 10 miles per hour. This range of speeds has been determined by many biomechanical researchers who have conducted tests with anthropometric dummies, whole cadavers and cadaveric specimens.^{4,5,6,7,8} The data collected from the Malibu studies conducted by General Motors, which are discussed in depth below, clearly demonstrate that even unrestrained occupants do not contact the roof with speeds much in excess of 3 miles per hour. The differential velocity required to produce a catastrophic neck injury like Misty Raley's comes from the defectively weak and rapidly intruding roof structure. Therefore, Misty Raley's restraint use status is entirely unrelated to the injuries she sustained in this rollover crash. Restrained and unrestrained occupants of rolling vehicles only suffer catastrophic neck injury when the roof crushes into the occupant compartment in the area that the occupant is located during the impact.

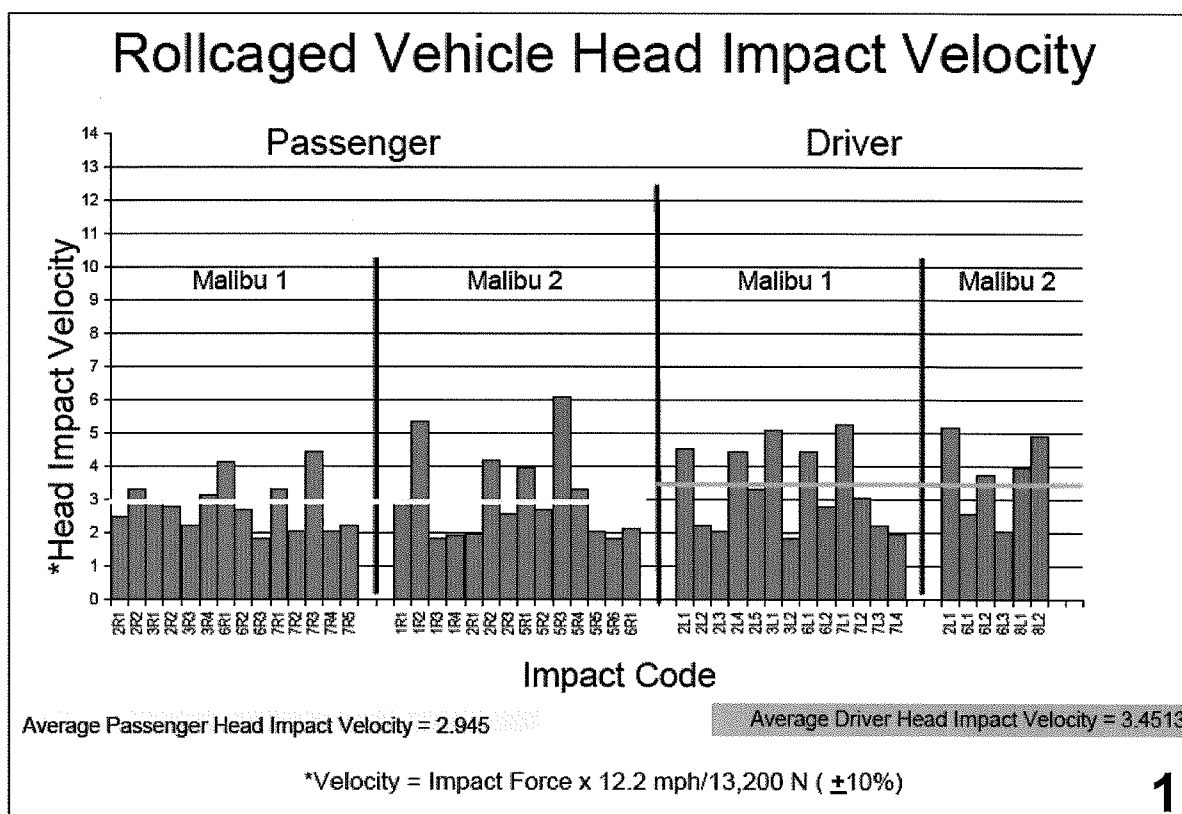


Figure 10: All impacts from Malibu rollcaged vehicles. The average head impact velocity for unrestrained dummies in Malibu I and restrained dummies in Malibu II was 2.9 mph for passengers

⁴ Mertz, H., Nyquist, G., et al., "An Assessment of Compressive Neck Loads Under Injury-Producing Conditions", 1978

⁵ Nusholtz, G., Huelke, D., et al., "Cervical Spine Injury Mechanisms", SAE 831616, 1983

⁶ Sances, A., Yoganandan, N., et al., "Spinal Injuries with Vertical Impact", 1986

⁷ Sances, A., Pintar, F., et al., "Biodynamics of the Total Human Cadaveric Cervical Spine", SAE 902309, 1990

⁸ Myers, B., Nightingale, R., et al., "The Dynamic Responses of the Cervical Spine: Buckling, End Conditions, and Tolerance in Compressive Impacts", SAE 973344, 1997

and 3.45 mph for drivers; well under the threshold for serious head or neck injury.

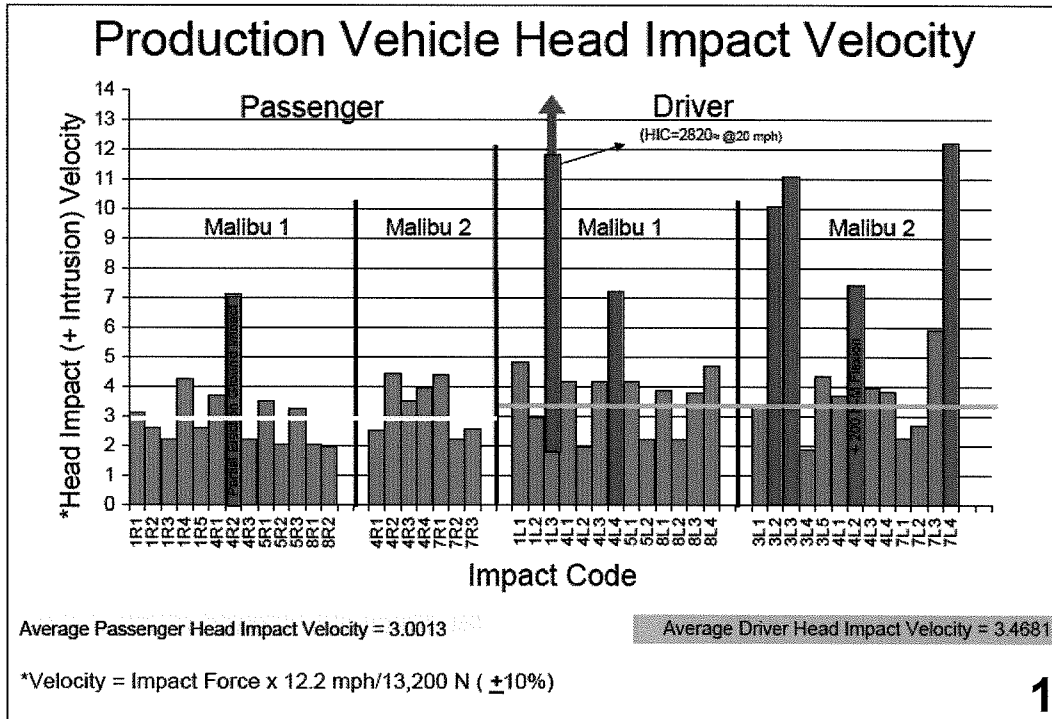


Figure 11: All impacts from Malibu production vehicles. The average head impact velocity for unrestrained dummies in Malibu I and restrained dummies in Malibu II was 3.0 mph for passengers and 3.46 mph for drivers; well under the threshold for serious head or neck injury – except in vehicles in which the roof catastrophically buckled and crushed into the occupant survival space. For these impacts the head impact velocity is in excess of 7 mph and, on four of the seven occasions, in excess of 10 mph.

Discussion:

Rollover casualties have been a focus of government regulation and of litigation for thirty-five years. The basic theory of occupant crash protection was established in 1952 in a Society of Automotive Engineering paper delivered in Detroit by Hugh DeHaven.⁹ In the 1960s, it was recognized that the two causes of occupant injury in rollovers concerned failures of the occupant compartment. The first was that unrestrained occupants were being ejected through open doors or windows, and the second was that occupants were being injured from roofs that

⁹ DeHaven, Hugh: "Accident Survival-Airplane and Passenger Automobile," A paper presented at the Annual Meeting of the Society of Automotive Engineers, January 1952.